Variability results of homogenized cottons by a new laboratory cotton homogenizing machine

Résultats de variabilité de cotons homogénéisés par le nouveau ouvreur-mélangeur de fibres de coton

GOURLOT J.-P.

Arusha, January 2012

From a joint work by:
A partir d'un travail conjoint de :
Payet L., Gourlot J.- P., Azuara C.
Présenté à l'ITMF, Bremen, March 2010

This project is co-funded by the European Union and the Common Fund for Commodities

Plan of presentation

- Introduction
- Homogenizing machine description
- Effect of machine on mixed cottons
- Effect of machine on homogenized cotton
- Conclusion

This project is co-funded by the European Union and the Common Fund for Commodities

Plan of presentation

- **Introduction**
- Homogenizing machine description
- Effect of machine on mixed cottons
- Effect of machine on homogenized cotton
- Conclusion

This project is co-funded by the European Union and the Common Fund for Commodities

Introduction

- Scope of the study
  - Prepare cottons for round tests
  - Several cottons covering a range of characteristics are tested
  - Goal: Compare every lab result to the labs mean result
    - ➔ **<u>Avoid raw material variability impact on laboratory results</u>**

This project is co-funded by the European Union and the Common Fund for Commodities

Introduction

- For any participating cotton
  - proper reading level within a chosen range for the required characteristics (many samples, many repetitions)
  - low variability
    - If good level, and low variability ➔ cotton selected
    - If not, according to given thresholds
      - Cotton rejected
      - **Cotton could be homogenized**

- CFC/ICAC/33 project, Regional round tests in Africa

This project is co-funded by the European Union and the Common Fund for Commodities

Introduction

- The homogenizing machine should ensure
  - a gentle processing (mean unchanged)
  - a decrease in within-cotton variability
  - an easy processing
  - an easy sampling of cotton fibre masses to be sent to every participating lab

This project is co-funded by the European Union and the Common Fund for Commodities

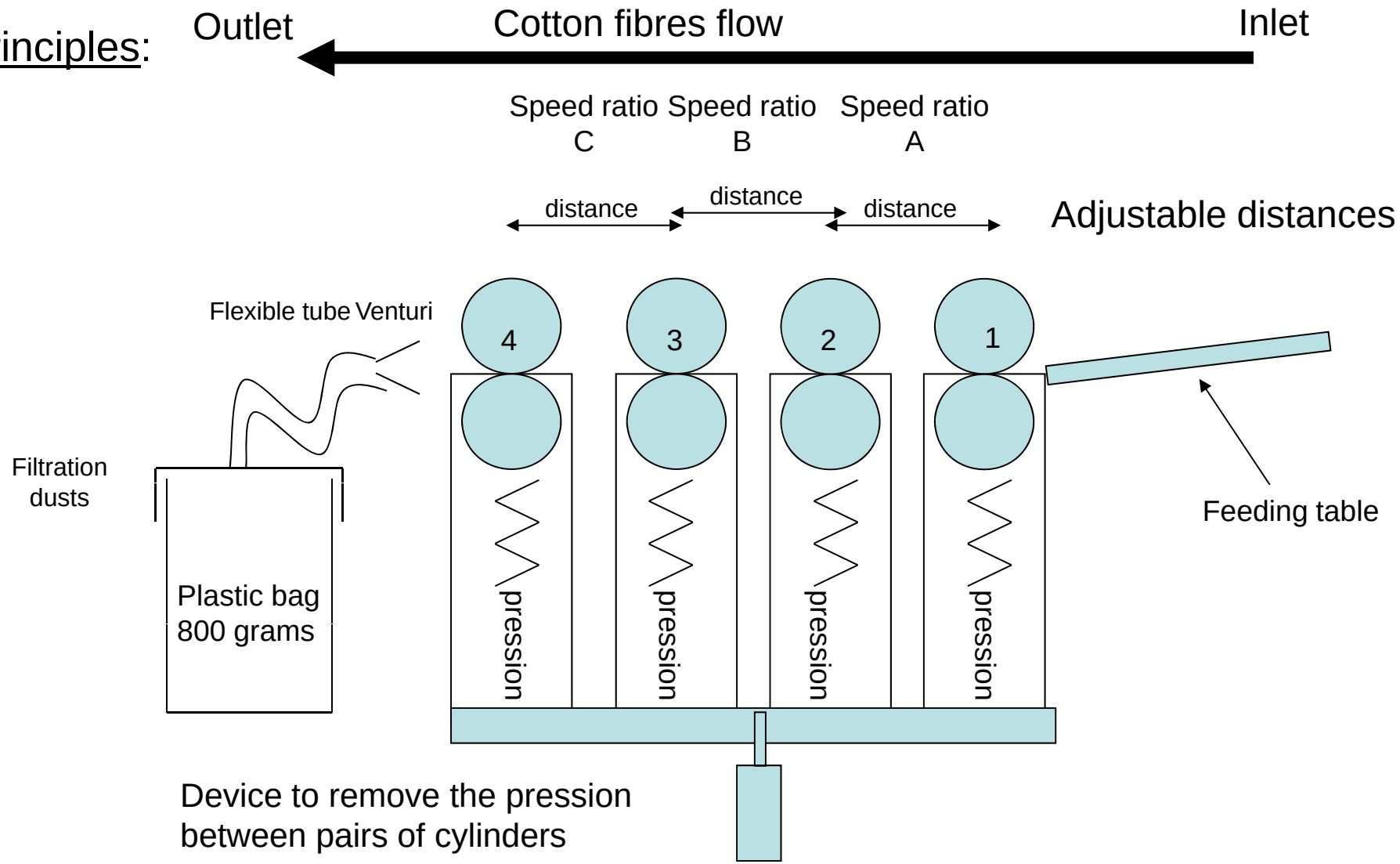
Plan of presentation

- Introduction
- **Homogenizing machine description**
- Effect of machine on mixed cottons
- Effect of machine on homogenized cotton
- Conclusion

This project is co-funded by the European Union and the Common Fund for Commodities

The homogenizing machine

Principles:



This project is co-funded by
the European Union and the
Common Fund for Commodities

The homogenizing machine

Picture:

This project is co-funded by the European Union and the Common Fund for Commodities

Plan of presentation

- Introduction
- Homogenizing machine description
- **Effect of machine on mixed cottons**
- Effect of machine on homogenized cotton
- Conclusion

This project is co-funded by the European Union and the Common Fund for Commodities

Mixing cottons with the machine

- Objective
  - Mix 2 types of cottons
  - Observe a difference of variability between “raw” and mixed samples

H0: homogenizing machine reduces the variability of two cottons chosen to be drastically different on their length and strength properties when mixed together

Exp. 1 small samples (40 g) → 1A: mixing
→ 1B: mixing+“doubling”

Exp. 2 larger masses (4 kg) → 2A: mixing
→ 2B: mixing+“doubling”

This project is co-funded by the European Union and the Common Fund for Commodities

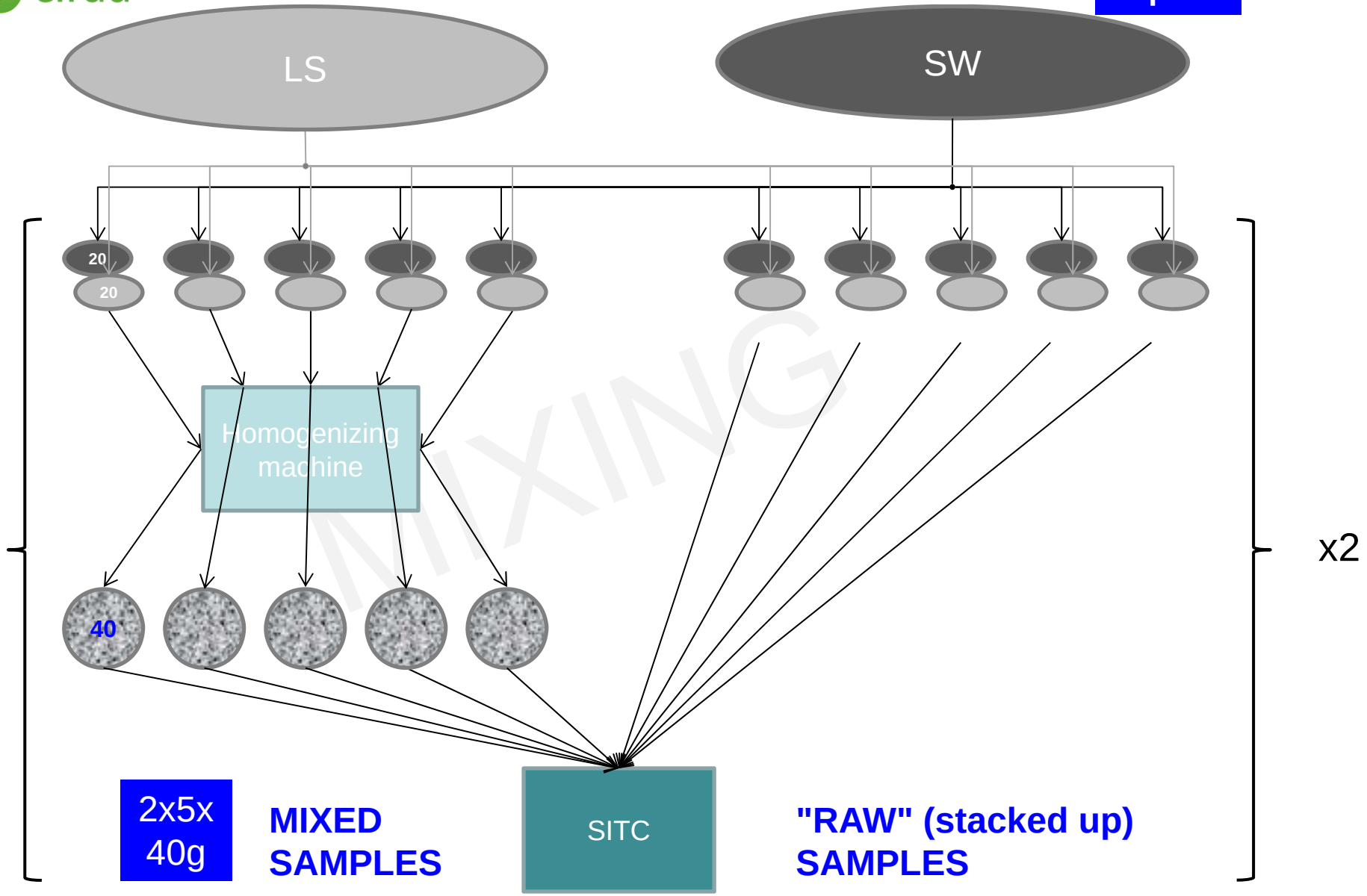
Mixing cottons with the machine

- Materials
  - Cottons: LS and SW stacked up on the feeding table
  - Homogenizing machine:
    - » Speed ratios fixed
    - » Distances between pairs of cylinders
    - » Pressure between cylinders
    - » Pressure drop in venturi
  - SITC testing:
    - HVI 1000 M700
    - 2 Mic, 6 LS, 6 CT on 40g or 200g samples

This project is co-funded by the European Union and the Common Fund for Commodities

Mixing cottons with the machine : Protocol

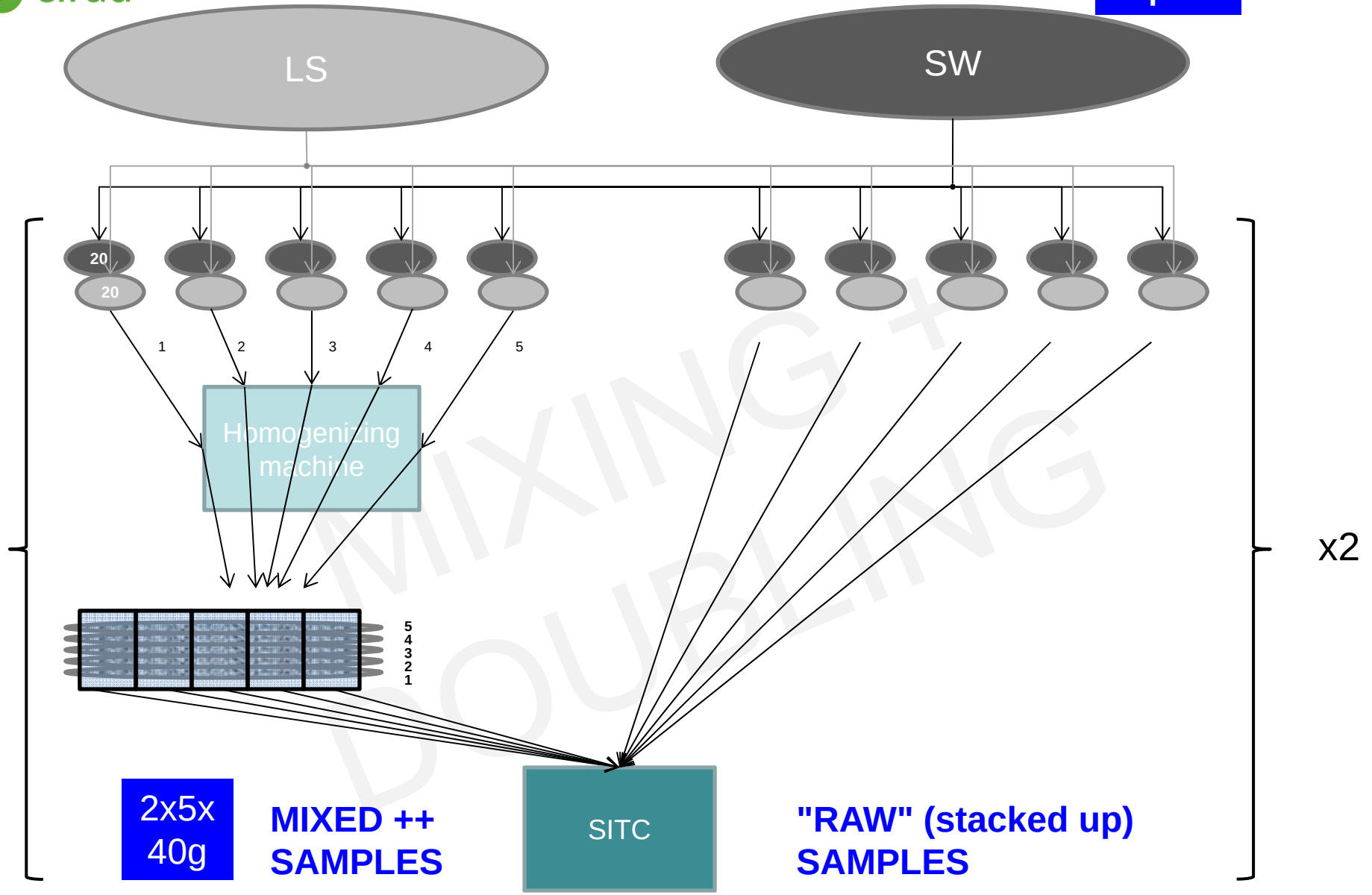
Exp. 1A



This project is co-funded by the European Union and the Common Fund for Commodities

Mixing cottons with the machine: Protocol

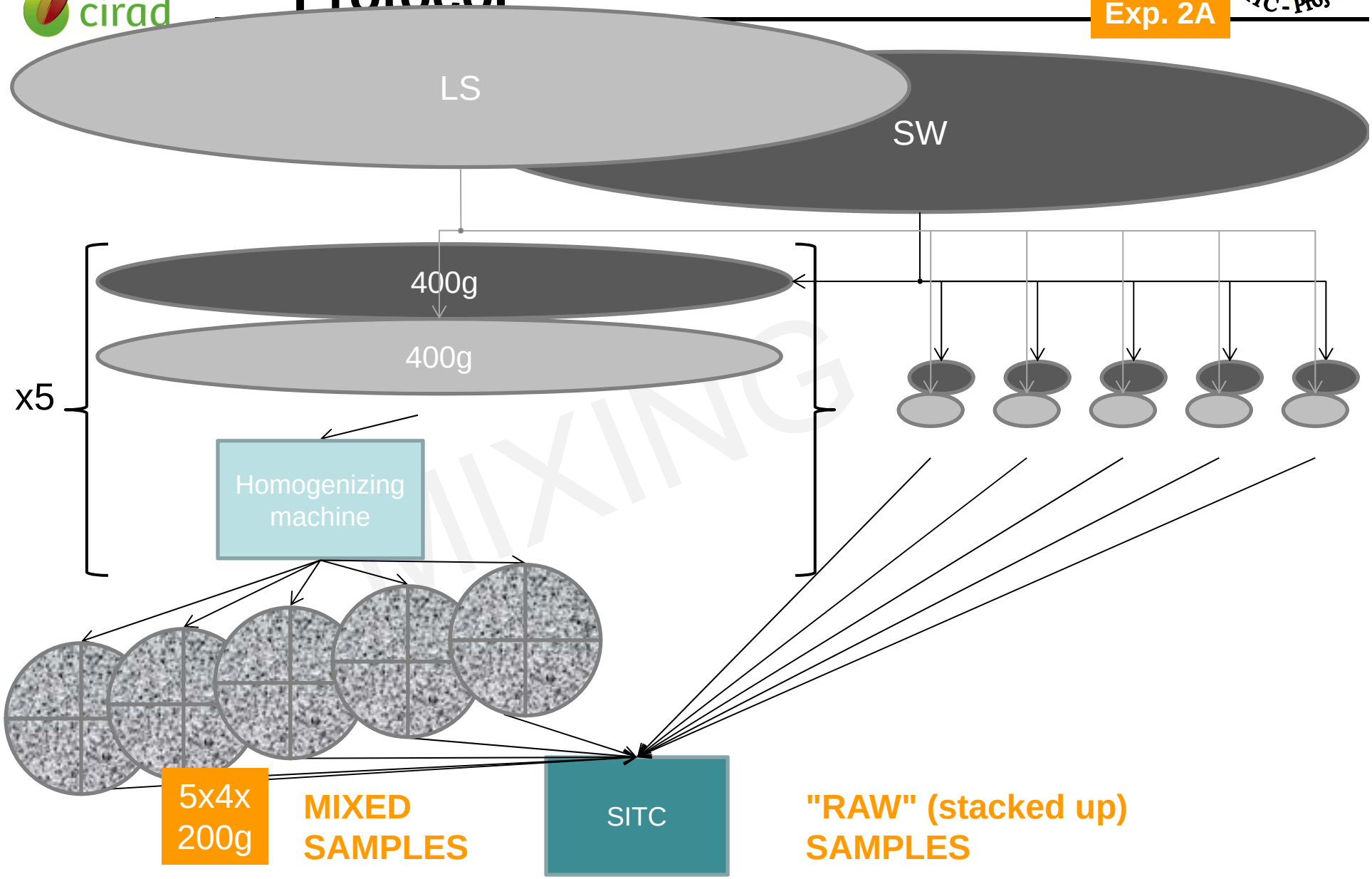
Exp. 1B



This project is co-funded by the European Union and the Common Fund for Commodities

Mixing cottons with the machine : Protocol

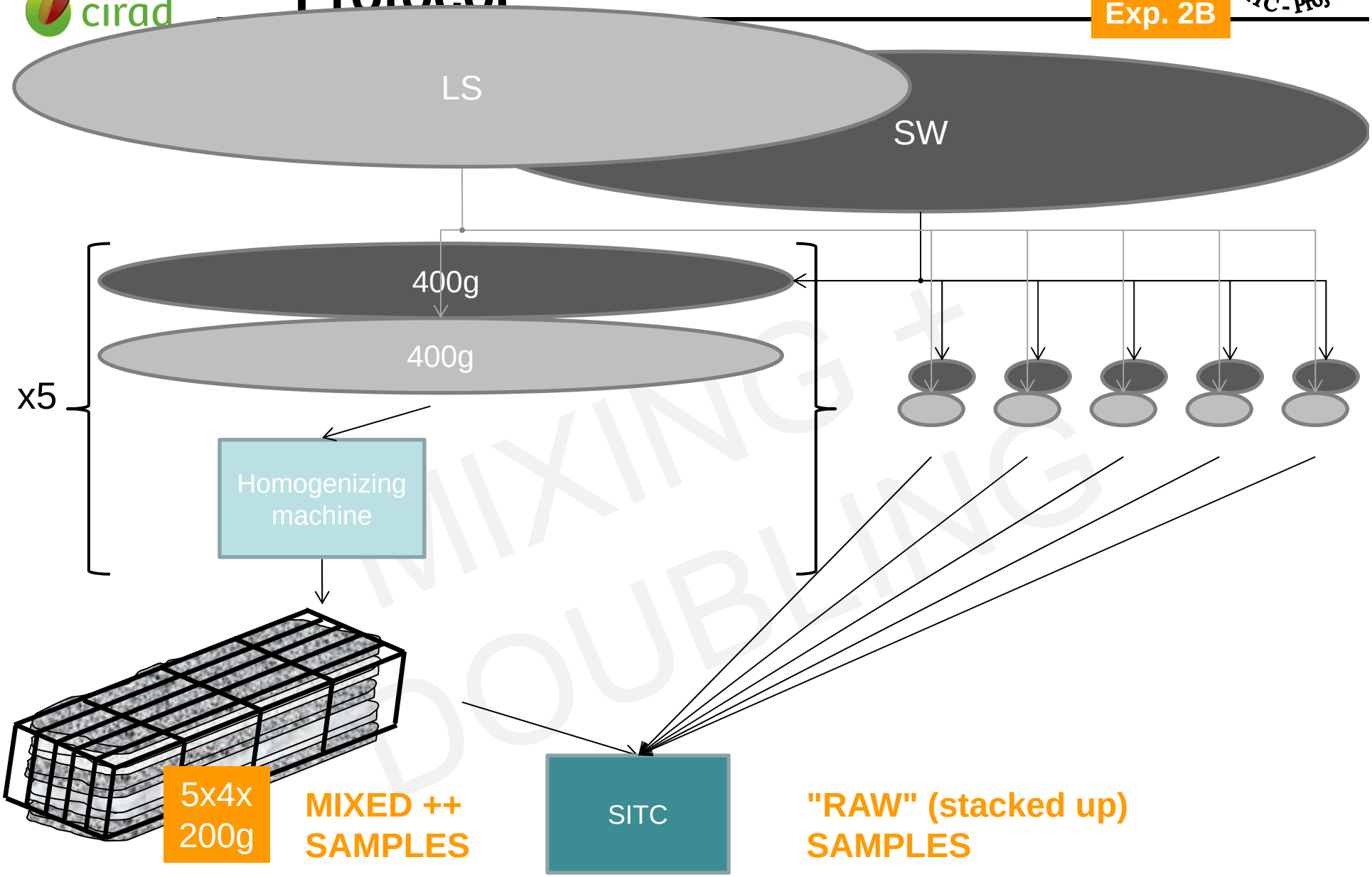
Exp. 2A



This project is co-funded by the European Union and the Common Fund for Commodities

Mixing cottons with the machine : Protocol

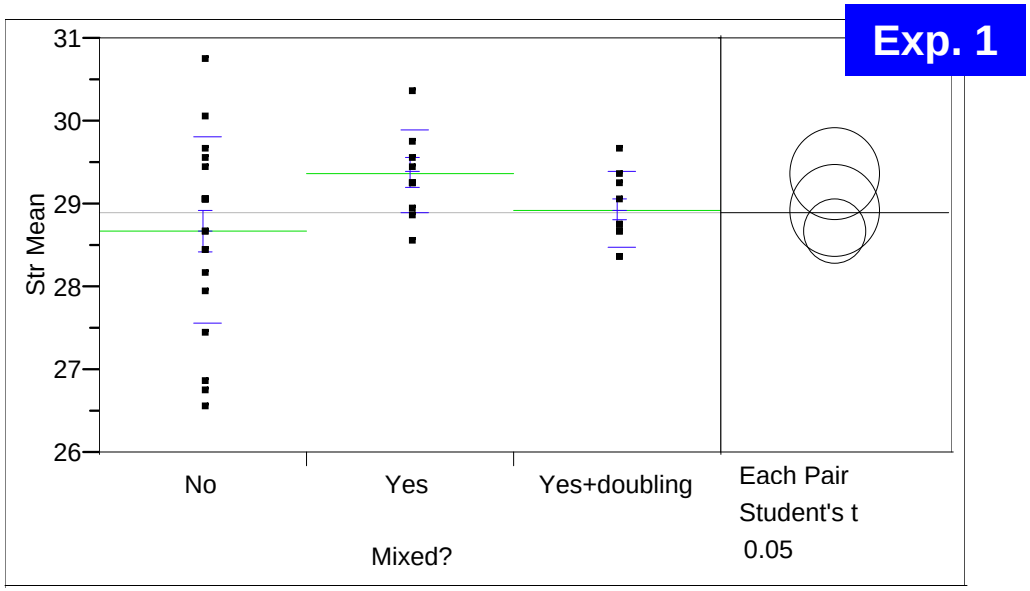
Exp. 2B

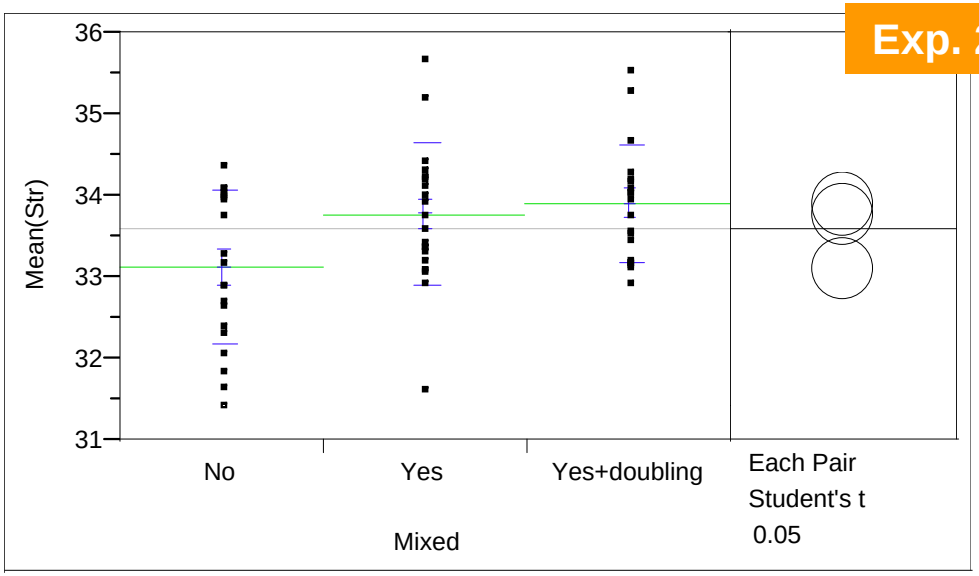


This project is co-funded by the European Union and the Common Fund for Commodities

Effect of machine on within-cotton variability: results

- Results
  - Example: strength





This project is co-funded by the European Union and the Common Fund for Commodities

Effect of machine on within-cotton variability: results

Mix small samples (40 g)

Exp. 1

F-ratio: raw:mixed

if > 1 → variability tend to decrease

the higher, the more effect of mixing

1A: mixing

Parameter	Mean		Variance		F ratio	Pr>F	Trend to
	Raw	M	Raw	M			
Mic	4.32	4.28	0.00221	0.00042	4.9	0.01	decrease significantly
UHML mm	27.97	28.31	0.20347	0.05514	3.5	0.03	decrease significantly
UI %	80.94	80.63	0.37292	0.14678	2.4	0.09	decrease
Str gf/tex	28.68	29.37	1.21747	0.25344	4.6	0.01	decrease significantly
Rd	77.33	77.51	0.05671	0.04767	1.1	0.45	decrease
+b	13.25	13.34	0.01842	0.00489	3.6	0.03	decrease significantly
	Raw	M+D	Raw	M+D			
Mic	4.32	4.27	0.00221	0.00049	4.3	0.02	decrease significantly
UHML mm	27.97	28.15	0.20347	0.01672	11.5	0.00	decrease significantly
UI %	80.94	80.36	0.37292	0.03378	10.5	0.00	decrease significantly
Str gf/tex	28.68	28.93	1.21747	0.18678	6.2	0.00	decrease significantly
Rd	77.33	77.67	0.05671	0.03122	1.7	0.20	decrease
+b	13.25	13.31	0.01842	0.00544	3.2	0.04	decrease significantly

1B: mixing and doubling

This project is co-funded by the European Union and the Common Fund for Commodities

Effect of machine on within-cotton variability: results

Mix larger samples (4 kg)

Exp. 2

F-ratio: raw:mixed *(inverted when in italic)*

if > 1 → variability tend to decrease *(to increase when in italic)*

the higher, the more effect of mixing

2A: mixing

Parameter	Mean		Variance		F ratio	Pr>F	Trend to
	Raw	M	Raw	M			
Mic	4.31	4.31	0.00234	0.00157	1.5	0.20	decrease
UHML mm	29.70	29.57	0.20706	0.18532	1.1	0.41	decrease
UI %	82.04	81.39	0.33311	0.74054	*2.2*	*0.04*	*increase*
Str gf/tex	33.11	33.78	0.86485	0.75136	1.2	0.38	decrease
Rd	79.39	79.68	0.04133	0.08167	*2.0*	*0.07*	*increase*
+b	11.54	11.52	0.05980	0.04802	1.2	0.32	decrease
	Raw	M+D	Raw	M+D			
Mic	4.31	4.30	0.00234	0.00123	1.9	0.09	decrease
UHML mm	29.70	29.52	0.20706	0.08164	2.5	0.02	decrease significantly
UI %	82.04	81.38	0.33311	0.17115	1.9	0.08	decrease
Str gf/tex	33.11	33.90	0.86485	0.50780	1.7	0.13	decrease
Rd	79.39	79.68	0.04133	0.01154	3.6	0.00	decrease significantly
+b	11.54	11.49	0.05980	0.01127	5.3	0.00	decrease significantly

2B: mixing and doubling

This project is co-funded by the European Union and the Common Fund for Commodities

Effect of machine on within-cotton variability: discussion

- The homogenizing machine enables a decrease in variability for the 6 CSITC criteria (UHML and Str) so the mixing effect can be considered as efficient.
- Mixing effect is more important for the procedure involving small samples.
- Additional doubling enables a greater decrease in variability, for both experiments involving small or larger quantities mixed.

This project is co-funded by the European Union and the Common Fund for Commodities

Plan of presentation

- Introduction
- Homogenizing machine description
- Effect of machine on mixed cottons
- **Effect of machine on homogenized cotton**
- Conclusion

This project is co-funded by the European Union and the Common Fund for Commodities

Homogenizing cotton with the machine

- Test in partnership with BBB
  - BCRT2008-4 and BCRT2009-4(H): same cotton
- Objective
  - BCRT2009-4: Homogenize large masses of cotton (50 kg) from one bale

    Procedure: machine+doubling described for Exp.2 (12 times)
  - Observe a difference of variability between material before and after homogenization

    H0: homogenizing machine reduces within-cotton variability

This project is co-funded by the European Union and the Common Fund for Commodities

Homogenizing cotton with the machine

- Materials
  - Cotton: West African Guinea Conakry (RM 40)
  - BCRT2009-4: Homogenizing machine
    - » Speed ratios fixed
    - » Distances between pairs of cylinders
    - » Pressure between cylinders
    - » Pressure drop in venturi
  - Internal experiment in one laboratory:
    - SITC testing: HVI 1000 M1000
    - 10 tests (1 Mic, 2 LS, 2 CT)

This project is co-funded by the European Union and the Common Fund for Commodities

Effect of machine on within-cotton variability: results and discussion

- Internal procedure to evaluate within-cotton variability

N(raw,2008) = 8
N(H,2009) = 10

F-ratio: raw:homogenized
if > 1 → variability decrease

	Mean		Variance		Ratio	Pr>F	Trend to
Parameter	**Raw**	**H**	**Raw**	**H**	**Var**		
Mic	3.34	3.44	0.003	0.000	7.0	0.00	decrease significantly
Str gf/tex	31.51	31.84	0.058	0.058	1.0	0.47	stable
UHML mm	28.93	28.57	0.062	0.011	5.9	0.01	decrease significantly
UI %	82.55	81.63	0.040	0.025	1.7	0.23	decrease
Rd	71.68	72.13	0.048	0.018	2.8	0.08	decrease significantly
+b	12.41	12.72	0.007	0.004	1.8	0.20	decrease

- Variability is reduced after homogenizing procedure → evaluation of the true inter-lab variability (due to laboratory practices, independently from cotton)

This project is co-funded by the European Union and the Common Fund for Commodities

Interpretation of inter-laboratory variability

- Complementary results (from RT):
  - Over 187 (2008-4) and 141 (2009-4) participating laboratories
  - Inter-lab variance results 2008-4 (Raw) and 2009-4 (H) :

Parameter	N		Mean		Variance		MD significant?	F Ratio	Trend to
	Raw	H	Raw	H	Raw	H			
Mic	74	74	3.40	3.43	0.011	0.007	no	1.6	decrease significantly
Str gf/tex	65	65	31.29	32.21	1.661	3.298	yes	*2.0*	*increase*
UHML mm	63	63	29.01	28.97	0.159	0.164	no	1.0	stable
UI %	59	59	82.57	82.34	0.324	0.457	no	*1.4*	*increase*
Rd	74	74	70.95	71.08	3.249	3.915	no	*1.2*	*increase*
+b	70	70	12.63	12.62	0.364	0.389	no	*1.1*	stable

F-ratios in italic: inverted from raw:H to H:raw in order to get F >1

→ Open to discussion

This project is co-funded by
the European Union and the
Common Fund for Commodities

cirad

Plan of presentation

Cotton Testing in Africa
CSITC - Project

- Introduction
- Homogenizing machine description
- Effect of machine on mixed cottons
- Effect of machine on homogenized cotton
- **Conclusion**

This project is co-funded by the European Union and the Common Fund for Commodities

Conclusion

The homogenizing machine ensures:

Very efficient for small quantities → Research samples

– a decrease in within-cotton variability while mean values remain unchanged (gentle process)

Applicable for CSITC RT in Africa

– when associated to an easy doubling process, sampling 4 kg of cotton fibre masses is easy before sending samples to participating labs

This project is co-funded by the European Union and the Common Fund for Commodities

Note

- Possibility to see the machine
  - + 1 machine at Faserinstitut Bremen, Germany
  - + 1 machine at RTC West (CERFITEX, Ségou, Mali)
  - + 1 machine at RTC East (TBS, Dar Es Salaam, Tanzania)
  - + 1 prototype at CIRAD, France

- Acknowledgements:
  - CFC/ICAC/33 project
  - A. Drieling, FIBRE

More details in:

Plus de détails dans :

PAYET L., GOURLOT J-P., 2011, Rapport “D.2.2. Development of a prototype of homogenizing machine, and production of simplified copies for RTCs, Public information”, Project CFC/ICAC/33, 38 p.

Thanks for your attention